# Solutions HW4 (Sec 2.7)

42. (a) $p = \frac{1}{38}$, $n = 70$ so $np = \lambda = \frac{35}{19}$. Let $X \sim Pois(\lambda)$. $P(X=0) = e^{-\lambda} = e^{-\frac{35}{19}}$

(b) $P(X=1) = e^{-\lambda} \cdot (\lambda) = \frac{35}{19} e^{-\frac{35}{19}}$

(c) $P(\text{won } \underline{\text{less}} \text{ than lost}) = P(X=0) + P(X=1) = 0.4504 < \frac{1}{2}$

$\Rightarrow P(\text{won } \underline{\text{more}} \text{ than lost}) > \frac{1}{2}$

48. $p = 0.01$, $n = 200$ so $np = \lambda = 2$. Let $X \sim Pois(\lambda)$.

$P(X \geq 4) = 1 - P(X=0) - P(X=1) - P(X=2) - P(X=3)$

$= 1 - e^{-2}\left(1 + \frac{2}{1} + \frac{2^2}{2} + \frac{2^3}{6}\right) = 1 - e^{-2}\left(5 + \frac{4}{3}\right) = 0.1429$

__Note__: We have used a (Poisson) __approximation__ to the true distribution, which is binomial with $n = 200$ and $p = 0.01$.

59. (a) $C_{40,3} = 27405$

(b) $\frac{C_{18,2} \cdot C_{12,2}}{C_{30,4}} = 0.3685$

65. There are $4 \cdot 5 = 20$ cards to avoid (10, J, Q, K and A of each of the 4 suits)

$\rightarrow$ $52 - 20 = 32$ cards are ok to pick for a Yarborough

$P(\text{Yarborough}) = \frac{C_{32,13}}{C_{52,13}} = 5.47 \times 10^{-4}$

67. $P(\text{exactly } 5/6 \text{ right } \underline{\text{or}} \text{ exactly } 6/6 \text{ right}) \overset{\text{disjoint events}}{=} P(\text{exactly } 5/6 \text{ right}) + P(\text{exactly } 6/6 \text{ right})$

$$= \frac{C_{9,5} \cdot C_{3,1}}{C_{12,6}} + \frac{C_{9,6}}{C_{12,6}}$$

$$= \frac{\frac{9 \cdot \cancel{8}^{2} \cdot 7 \cdot 6}{\cancel{4} \cdot 3 \cdot 2} \cdot 3 + \frac{9 \cdot 8 \cdot 7}{3 \cdot 2}}{\frac{\cancel{12}^{2} \cdot 11 \cdot \cancel{10}^{2} \cdot 9 \cdot \cancel{8}^{2} \cdot 7}{\cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3 \cdot 2}}} = \frac{\cancel{9 \cdot 7}\left(\cancel{2}^{3} \cdot 3 \cdot 2 + \cancel{8}^{2}\right)}{\cancel{9 \cdot 7} \cdot 11 \cdot \cancel{8}_{2}}$$

$$= \frac{9 + 2}{11 \cdot 2} = \frac{\cancel{11}}{\cancel{11} \cdot 2} = \frac{1}{2}$$